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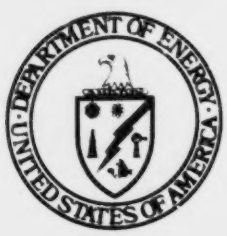
Analysis Report

Projections of U.S. Petroleum Supply/Demand by Quarters Through 1980

August 1979

U.S. Department of Energy
Energy Information Administration
Assistant Administrator for Applied Analysis



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Analysis Report

Projections of U.S. Petroleum Supply/Demand by Quarters Through 1980

AR/IA/79-37

August 1979

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PREFACE

The Energy Information Administration published an Analysis Report in June 1979, "Energy Supply and Demand in the Short-Term: 1979 and 1980." That report was prepared too early to take into account important new developments in the petroleum sector, such as the mid-year OPEC price increases and recent Presidential decisions to accelerate decontrol of domestic crude oil prices and to limit the volume of U.S. petroleum imports.

This report provides revised quarterly projections for 1979 and 1980 for petroleum supply and demand. The revised projections take these newer developments into account and reflect recent changes in the economic outlook and the availability of petroleum supplies.

Frank Hopkins, Chief of the Short-Term Analysis Division, directed the preparation of the study.

The authors are indebted to David Ahl, Neil Gamson, Ray Fuller, Robert Damuth, Gerald Lagace, Ted McCallister, and Mitchell Durst for their contributions and guidance in preparation of the study. Richard Farmer, Kenneth L. Kincel, and Charles Mylander provided a technical review and suggested improvements. Patricia Francis and Helen Taylor handled the difficult tasks of typing and organizing the report for publication.

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SUMMARY

This Analysis Report continues a series of assessments on the short-term petroleum outlook prepared within Applied Analysis, Energy Information Administration (EIA). The projections extend, by quarters, through 1980 covering the period for analysis in Chapter 3 of the EIA Annual Report to Congress 1978, Volume Three, "Short-Term Energy Supply and Demand 1979-1980."

New developments, following the shortage of world oil supplies in early 1979 and changes in U.S. energy policy and programs since Chapter 3 of the Annual Report was prepared, are reflected in this analysis. Changes in the economic outlook in recent months and mounting increases in the prices of world oil and in costs and prices of domestic supply have reduced the earlier assessments of demand growth. In the base case that is developed, demand in the last two quarters of 1979 falls below that in the same period of 1978 by 1.6 percent, reflecting recessionary influences forecast in those quarters. Despite economic recovery in 1980, petroleum demand for the full year is unchanged from the full-year estimate for 1979.

Domestic production is also projected to change very little between the two years. Crude oil production is projected at slightly more than 8.5 million barrels daily in 1979 and to fall only slightly below that level in 1980. Production increases from the Alaskan North Slope tend to offset declines in the rest of the country.

Consequently, imports required to meet base-case demands are relatively unchanged from 1979 to 1980. With the world supply situation apparently improved in recent months, it appears that base-case requirements can be met without further resort to supply allocations.

Demand sensitivity cases are included to show the impact of alternative values in the forecasts of the key variables. The models are most sensitive to variations in the economic forecasts, with differences from base-case projections reaching as much as 420,000 barrels daily by the end of 1980. The impacts of variations in product price levels and severity of winter weather appear much lower, but nevertheless significant. Weather effects may be localized and centered on individual products (fuel oils), and the resultant impacts may be more severe than suggested by the national totals.

However, the sensitivity analyses suggest that petroleum demand variations, given foreseeable alterations in economic, weather, and price forecasts, are unlikely to be large enough to create problems of the magnitude faced during the winter and spring quarters of 1979. Indeed, when a first order approximation to a worst import case of high economic growth, base-case prices, and very cold weather was analyzed, import requirements were only projected to increase as much as 360,000 barrels daily in the fourth quarter of 1979 and first quarter of 1980 over the base case net import figures of 7.9 and 8.1 million barrels daily respectively.

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I. INTRODUCTION

The Energy Information Administration has published a series of reports during 1979 on the short-term U.S. petroleum outlook. A March 1979 report[1/] presented base case projections through the first quarter of 1980. These reports were designed to facilitate comparative analysis of the disruptive effects of world oil shortages following the curtailment of Iranian oil exports. A report in June 1979[2/] presented new projections of U.S. petroleum supply and demand, for the same time period, but that report reflected the impact of oil shortages, higher prices, and public and private responses to changing conditions following the Iranian cutback.

This report updates and revises projections in the June study and provides an analysis of the potential effects on U.S. petroleum demand of variations in economic activity, weather conditions, and the levels of petroleum product prices.

A special feature that is included is the analysis of import requirements under varying conditions affecting U.S. petroleum supply and demand. The prospects for domestic petroleum production and the need to rebuild petroleum inventories to satisfy future demand are studied in relation to the achieving of announced U.S. petroleum target import levels.

1/ U.S. Department of Energy, EIA, "Base Case Projections of Petroleum Supply/Demand Through the First Quarter of 1980", DOE/EIA-0102/49

2/ U.S. Department of Energy, EIA, "Current U.S. Petroleum Situation and Short-Term Supply/Demand Outlook", DOE/EIA-0184/5

II. APPROACH AND ASSUMPTIONS

This report particularly emphasizes the potential U.S. demand for petroleum during the coming winter and the remaining quarters of 1980. A set of "base-case" demands for major products was developed, assuming continuation of current expectations for key variables that affect petroleum consumption. Alternative assumptions regarding these key variables were used to generate demand sensitivities as departures from the base-case expectations.

The variations in demand projections due to changing prospects for economic growth, severity of winter weather, and petroleum prices indicate the varying supply levels needed in the event that these more extreme conditions materialize. A combination of extremes for these variables could occur, but scenarios based on such less-probable conditions are not presented. Consequently, this report does not include scenarios which generate the widest possible ranges of very high or very low projections. However, using the sensitivity analyses contained herein, one can estimate these ranges, to a first-order approximation, by adding the effects of individual parameter variations.

The assumptions, outlined in Table 1, indicate the combination of mid-level expectations for economic activity, weather, and oil prices applicable to the base-case scenario. The high and low levels for each of the key variables are applied only to the sensitivity analysis, as opposed to their application in combinations to generate

TABLE 1

ECONOMIC, PRICE AND WEATHER ASSUMPTIONS FOR PETROLEUM DEMAND PROJECTIONS

Quarters:	1979 Historical 1st	1979 Historical 2nd	1979 Projected 3rd	1979 Projected 4th	1980 Projected 1st	1980 Projected 2nd	1980 Projected 3rd	1980 Projected 4th
ASSUMPTIONS FOR THE BASE CASE								
Economic Assumptions								
Real GNP		P						
(Billions of 1972 dollars)	1431	1419	1404	1396	1402	1415	1431	1448
% change from prior year	5.7	2.6	0.9	-1.2	-2.0	-0.3	1.9	3.7
% change from prior quarter a/	0.3	-0.8	-1.1	-0.6	0.4	0.9	1.1	1.2
Price Assumptions (dollars per barrel) b/								
World Crude Oil (FAS Foreign Ports)	14.18	16.84	20.00	20.34	20.69	21.04	21.40	21.79
Refiner Acquisition Cost (Average for foreign and domestic crude oil)	13.41	14.52 c/	17.61	18.39	18.74	20.30	20.16	21.51
Weather Assumptions		E						
Heating Degree Days d/	2763	587	92	1674	2399	543	92	1674
ASSUMPTIONS FOR THE SENSITIVITY CASES								
Economic Assumptions								
Real GNP (billions of 1972 dollars)								
Low			1403	1382	1377	1369	1383	1400
High			1416	1420	1425	1431	1438	1448
Price Assumptions (dollars per barrel)								
World Crude Oil								
(FAS Foreign Ports) Control (as in base case)			20.00	20.34	20.69	21.04	21.40	21.79
High			23.50	23.90	24.31	24.72	25.15	25.60
Refiner Acquisition Costs								
(Average for foreign & domestic crude oil)								
Control			17.36	18.08	18.13	19.29	18.73	19.53
High			19.78	20.65	21.08	22.97	22.91	24.57
Weather Assumptions e/								
Winter Heating Degree Days								
Cold (110% of Normal)			N/A	1841	2639	N/A	N/A	1841
Very Cold (120% of Normal)			N/A	2009	2879	N/A	N/A	2009

P = Provisional data from Dept. of Commerce (DOC) News Release, BEA 79-46, July 20, 1979.
E = Estimated

a/ Quarter to quarter changes, not at an annualized rate as normally reported by DOC
b/ The historical prices are unweighted three month averages of nominal prices
c/ Represents April only
d/ The projected HDD are the national 30-year normals by quarter
e/ HDD variations apply to the first and fourth quarters only (the heating season).
NA Not Applicable

high or low scenarios involving all variables. The use of sensitivity analysis rather than of scenario presentations represents a departure from the format of the earlier March and June Reports.

Price Assumptions

Price projections in this report are based on expected changes in refiners' crude oil costs along with the escalation of other costs in the refining and distribution of petroleum products. Crude oil costs reflect both changes in world oil prices and changes in the price of domestic crude oils under the phased decontrol program and the movement of domestic crude oil prices towards world price levels.

World oil prices are based upon the most recently announced Organization of Petroleum Exporting Countries (OPEC) prices with future escalation in prices assumed to offset inflation, as reflected by the implicit price deflator for the U.S. gross national product (GNP). At the recent (June 1979) meeting of the OPEC oil ministers, the official price of Saudi Arabian Light crude oil, which has been the benchmark crude for OPEC prices, was increased to $18.00 a barrel, a 24 percent increase over the official price announced three months earlier. Members of OPEC were free to add surcharges or set their prices at higher levels up to a price of $23.50 per barrel, f.a.s., the foreign port. In mid July, the estimated average OPEC crude oil price, weighted by export volumes, was $20.64 per barrel, f.a.s. For purposes of this study, average world oil prices were assumed to range from $20.00 to $23.50 per barrel in the third quarter of 1979. For

subsequent quarters, these prices were assumed to escalate with the GNP implicit price deflator to the nominal price levels shown in Table 1.

Domestic crude oil prices are projected to increase under the announced schedules for phased decontrol. As of this writing, final regulations on all aspects of the decontrol program have not yet been promulgated. To the extent that final regulations differ from the assumptions used in this report, the projections would have to be modified.

The decontrol program can be summarized as follows (The White House Fact Sheet on the President's Program, April 5, 1979, pp. 9-10):

- Newly discovered oil on or after June 1, 1979, receives the world market price of crude oil.
- Eighty percent of "marginal" crude production shifts from the lower-tier to the upper-tier price category on June 1, 1979. The remaining marginal production goes to upper-tier on January 1, 1980. The Economic Regulatory Administration (ERA) has estimated marginal production at 550 thousand barrels daily.
- Incremental new production from tertiary recovery projects after June 1 may receive the world price.
- Upper-tier oil prices increase in equal monthly increments toward the world price, beginning January 1, 1980, reaching parity with the world price by October 1, 1981.
- Lower-tier crude is put on a decline rate of 1.5 percent per month beginning June 1, 1979, increasing to 3 percent per month on January 1, 1980, allowing that much of the lower-tier production to receive the higher, upper-tier price.

It should be noted that all lower-tier and upper-tier crude oil production is under price controls. Lower-tier crude oil is the amount of crude oil production for a given property for a given month up to the amount of base period production. Base period production is the lesser of either 1972 or 1975 monthly production for the property, with a downward adjustment to take account of depletion of the oil field. Part of the decontrol phaseout program is to accelerate this downward adjustment, or decline rate. Lower-tier crude, as of March 1979, was selling for an average of $5.82 per barrel.

Upper-tier crude oil is the amount of crude oil production, beyond base period production, for a given property in a given month. Upper-tier crude, as of March 1979, was selling for an average of $12.84 per barrel. Wells producing less than 10 barrels a day of crude oil are exempt from price controls and were selling at $14.88 a barrel at the same time.

The decontrol program has been included in the projections by directly incorporating three of the proposed decontrol program's features, namely the "marginal" production shift, the increase in upper-tier price, and the accelerated decline rate for lower-tier crude production. It is assumed that the effect of allowing newly discovered oil to receive the world price would be to displace that much equally priced imported crude oil, and therefore not affect the average cost of the crude mix available to domestic refiners.

Regulations concerning the shift of "marginal" crude from lower-tier to upper-tier, and the accelerated decline rate of lower tier, have been

published by Department of Energy (DOE). Regulations concerning the increase in upper-tier prices have not yet been published, and may differ in their final form from the assumptions made in these projections.

Table 1 shows the projected refiner acquisition costs of crude oil based on the control and high projections of world oil (OPEC) prices and increases in domestic prices under the new decontrol schedules. In order to show the impact of the announced schedule of phased decontrol, the refiners' acquisition costs are also shown without phased decontrol when world oil prices are at the low end of the projected range. As indicated, the phased decontrol program (assuming the identical OPEC price trajectory) is projected to increase refiner acquisition costs of crude oil by about $2.00 a barrel by the end of 1980. Through 1979, the impact is basically the effect of shifting most "marginal" crude oil from the lower-tier to the upper-tier category; this amounts to about $0.30 a barrel, or less than a penny a gallon. During 1980, however, the accelerated decline rate of lower-tier oil, and the increasing prices of upper-tier oil, cause the difference between the control and base cost projections to increase from about $0.60 a barrel in the first quarter, to almost $2.00 a barrel by the fourth quarter.

Economic Assumptions

The economic assumptions were developed from the June 1979 Data Resources, Inc. (DRI) forecasts, labeled SLOWGROWTH063079, CONTROL062879, and DEEPRECESSION063079. These DRI forecasts represent the near-term prospects for the economy.

The optimistic or high case (SLOWGROWTH063079), anticipates no recession, but projects a slow rate of growth in GNP from the third quarter of 1979 through the forecast interval. The inflation rate is expected to be higher for the forecast interval than in the base case.

The most likely DRI case (CONTROL062879) represents a significantly deteriorating economic outlook as compared with the last DRI forecast. Other major forecasting services concur that the economy will endure a recession in 1979, with a recovery occurring sometime in 1980. DRI forecasts three consecutive quarters of negative real growth, starting with the second quarter of 1979 and a slow recovery thereafter. However, the economic recovery progressing through 1980 is such that real GNP in the fourth quarter of 1980 is equal to real GNP in the high economic scenario. Inflation is anticipated to improve significantly by the end of the year as the recession eases some of the current imbalances.

The pessimistic or low case (DEEPRECESSION063079) is characterized by a larger and deeper recession and worse near-term inflation than the control case. The late third quarter recovery in 1980 leaves real GNP by the end of 1980 still below actual second quarter 1979 levels.

Table 1 presents the real 1972 dollar GNP levels from these DRI forecasts which yielded the upper and lower bounds and base case projections of economic activity during the period.

Weather Assumptions

In the base case, weather was assumed to be the 30-year average of heating degree days (HDD) based on the period 1941-1970 (population weighted). Heating degree days for the cold and very cold cases are 110 percent and 120 percent of the 30-year mean during the first and fourth quarter, respectively. The 20 percent colder winter (October through March) represents an extreme condition; for example, the severe winter of 1976-77 was 14 percent colder than normal. The individual Petroleum Administration for Defense districts, however, display highly variable weather trends. For example, in the fourth quarter of 1978, PAD 1 (the entire east coast) was 41 percent warmer than normal while PAD 5 (the entire west coast) was only 6 percent warmer than normal.

III. PROJECTIONS OF PETROLEUM PRODUCT PRICES

Projections of product prices involved use of the short-term petroleum cost distribution model, which calculates petroleum product prices based on changes in crude oil costs (both domestic and imported), refiners' and marketers' markups, and historical seasonal patterns. The price projections shown in Table 2 are based on alternative assumptions regarding OPEC prices (as discussed in Section II), and the phased decontrol of domestic crude oil prices. The projections assume a dollar-for-dollar passthrough of crude oil cost increases, and increases in refiners' and marketers' markups. Markups of product prices in these projections are assumed to increase with general inflationary trends, as measured by the GNP implicit price deflator. Two exceptions to this general assumption are:

- Refiners' gasoline markups are determined by their allowable nonproduct costs, which in turn are determined by average nonproduct costs for all refined products, and by gasoline yields. Price regulations allow refiners to pass a more than volumetrically proportionate amount of their nonproduct costs through to gasoline prices, depending upon yields. These price increases can exceed the general rate of inflation.
- Retailers' price markups on gasoline purchased from refineries are not assumed to escalate over the forecast period. New regulations allowing a 15.4 cent per gallon margin for retailers of gasoline through 1979, and higher margins in 1980, could add about 5 cents per gallon to gasoline prices over and above the projections.

TABLE 2

PROJECTED NOMINAL PRICES FOR REFINED PETROLEUM PRODUCTS

Quarter	Price Cases	Motor Gasoline a/ (¢/gallon)	Distillate Fuel Oil b/ (¢/gallon)	Residual Fuel Oil c/ ($/barrel)
	Control d/	83.2	45.4	16.58
1979-II	Base	83.2	45.4	16.58
	High	83.2	45.4	16.58
	Control	91.7	50.6	18.54
1979-III	Base	92.3	51.2	18.67
	High	96.4	54.6	20.64
	Control	93.5	52.3	19.44
1979-IV	Base	94.2	53.0	19.60
	High	100.3	58.2	22.57
	Control	94.2	53.9	20.51
1980-I	Base	95.4	55.0	20.76
	High	101.6	60.2	23.80
	Control	96.6	54.5	21.06
1980-II	Base	98.8	56.5	21.52
	High	105.5	62.3	24.71
	Control	98.5	55.6	20.60
1980-III	Base	101.7	58.5	21.29
	High	109.1	64.9	24.64
	Control	99.1	56.4	20.93
1980-IV	Base	103.7	60.5	21.90
	High	111.6	67.3	25.40

a/ Regular leaded motor gasoline at full service pumps.
b/ Wholesale No. 2 distillate (rack prices, does not include transportation)
c/ Wholesale No. 6 residual fuel oil, 0.31% to 1.0% sulfur content.
d/ Control is not an EIA forecast, but is used as a reference price to analyze the price impact of decontrol in relation to the base case that that includes decontrol.

In general, the methodology is consistent with the DOE's petroleum product price regulations. Of the major refined petroleum products, only gasoline remains under mandatory price and allocation controls. Therefore, prices for the other petroleum products, depending upon market conditions, could exceed these projections.

The assumptions for each of the three sets of price projections given in this report are as follows:

Control Case - This case is designed as a benchmark against which to measure the impact of the phased decontrol of domestic crude oil prices. World oil prices (weighted average f.a.s. prices) are assumed to average $20.00 per barrel in the third quarter of 1979, and to increase at the same rate as the GNP implicit price deflator thereafter.

Base Case - The phased decontrol of domestic crude oil prices is assumed to be in effect, with world oil prices following the same trajectory as in the Control Case. Comparison of Control and Base Case projections indicates the impact of phased decontrol.

High Prices Case - Again, the phased decontrol of domestic crude oil prices is assumed to be in effect. However, OPEC prices are assumed to average $23.50 per barrel in the third quarter of 1979, with increases at the same rate as the GNP implicit price deflator thereafter.

As Table 2 indicates, the world oil price assumptions have a greater impact upon product prices than the accelerated schedule of decontrol.

By the end of 1980, crude oil decontrol (holding constant the trajectory for world oil prices) is projected to add about 4.6 cents per gallon to gasoline prices, 4.1 cents per gallon to distillate prices, and $0.97 per barrel to residual fuel oil prices. The high OPEC price assumptions (assuming the decontrol program to be in effect) add 7.9 cents per gallon to gasoline prices, 6.8 cents per gallon to distillate prices, and $3.50 per barrel to residual fuel oil prices. The higher gasoline price increases (relative to distillate) can be attributed to the gasoline "tilt" regulations, which allow refiners to pass a higher than volumetrically proportional amount of their costs to gasoline prices. Residual fuel oil price increases are still higher, due to the substantial portion of residual fuel oil which is imported, and which is assumed to increase in price at the same rate as imported crude oil costs.

IV. BASE CASE DEMAND PROJECTIONS

Table 3 shows the historical consumption data for the four quarters of 1978 and the first two quarters of 1979. Projections for the last two quarters of 1979 and all four quarters of 1980 are based on base-case economic activity, normal weather, and base-case prices. Demand projections reflecting high and low economic growth, weather, and prices are presented as sensitivity cases later in the report.

Total petroleum demand for the remaining quarters of 1979 is projected to be below the corresponding quarters of 1978. This decline continues into the first quarter of 1980, which is 3.6 percent below consumption in the first quarter of 1979. These reductions reflect a combination of a slowdown in economic growth and an increase in the real price of petroleum products. While second quarter 1980 demand increases from the 1979 second quarter by 3.4 percent, the absolute level of demand remains as low as it was two years earlier. The second quarter 1979 consumption of 17.41 MMB/D is misleadingly low, reflecting curtailed deliveries of refined products to consumers during this period because of crude oil shortages following the curtailment of oil exports by Iran. Projected demand remains low in the last two quarters of 1980 with only a modest increase from the 1979 demand projections.

Motor gasoline consumption was significantly affected by the reduction in oil supply in the second quarter of 1979. Motor gasoline consumption of 7.09 MMB/D represented a reduction of 7 percent from the same quarter in 1978.

Table 3

PROJECTIONS OF U.S. [a/] QUARTERLY PETROLEUM DEMAND
With Medium Economic Growth, Normal Weather, and Base-Case Prices
(millions of barrels daily)

	Historical						Projected					
	1978				1979		1979		1980			
					R	R P						
Quarters:	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th
Motor Gasoline	6.94	7.62	7.62	7.48	7.12	7.09	7.54	6.92	7.01	7.60	7.54	7.02
Distillate Fuel Oil	4.44	2.99	2.65	3.59	4.31	2.91	2.64	3.66	4.14	2.93	2.66	3.70
Residual Fuel Oil	3.66	2.76	2.81	2.86	3.45	2.60	2.67	2.99	3.31	2.49	2.66	3.07
Other Products	5.00	4.67	4.98	5.24	5.42 [b/]	4.81	5.10	5.11	5.11	4.98	5.08	5.20
TOTAL	20.04	18.04	18.06	19.17	20.30	17.41	17.95	18.68	19.57	18.00	17.94	18.99
	(Percent change from same period in prior year)											
Motor Gasoline	2.7	4.1	3.1	3.5	2.6	-7.0	-1.0	-7.5	-1.5	7.2	0.0	1.4
Distillate Fuel Oil	.7	5.7	.8	.8	-2.9	-2.7	-0.4	1.9	-3.9	0.7	0.8	1.1
Residual Fuel Oil	14.0	-3.2	-.1	-3.4	-5.7	-5.8	-5.0	4.5	-4.1	-4.2	-0.4	2.7
Other Products	0.6	3.1	3.5	4.2	8.4 [b/]	3.0	2.4	-2.5	-5.7	3.5	-0.4	1.8
TOTAL	1.7	2.9	1.6	2.1	1.3	-3.5	-0.6	-2.6	-3.6	3.4	-0.1	1.7

R = Revised since issuance of the June 1979 issue of the EIA, "Monthly Energy Review" (MER)
P = Provisional, based on data in the U.S. Department of Energy "Weekly Petroleum Status Report" and American Petroleum Institute "Monthly Statistical Report", June 1979)

a/ 50 states only
b/ Change in reporting of Natural Gas Liquids (NGL) results in basic discontinuity in the demand series including products derived from NGL (see MER, July 1979 pg. 44)

The projections for the six quarters assume that gasoline curtailments will not occur over the forecast period. The large decline in gasoline consumption of 7.5 percent in the fourth quarter of 1979, in relation to the previous year, is caused by a high 1978 base (because of extended warm weather), as well as declining economic growth and rising real prices.

Weather has such a strong influence on U.S. petroleum demand that year-to-year changes can be misleading unless adjusted for weather factors. Temperature is the most significant factor, but rainfall is also important, especially through its impact on the generation of electricity from hydro facilities. In the fourth quarter of 1978, mild temperatures and the recovery from the drought of the previous year contributed to a decline in residual fuel oil demand of 3.4 percent from the fourth quarter of 1977. This low fourth quarter 1978 level, then, contributes to the relatively high growth rates of residual fuel oil (4.5 percent) from the fourth quarter of 1978 to the fourth quarter of 1979, when normal weather conditions are assumed. The average growth rates for the first three quarters of 1980 are negative in relation to 1979 as a result of reduced economic growth and high prices.

Distillate fuel oil demand was also affected by mild weather in the last half of 1978. Although demand for distillate fuel oil was up less than 1 percent in the second half of 1978 versus 1977, stocks were not rebuilt to the levels reached in late 1977, because refiners shifted production to increase the output of gasoline where demand was stronger.

The return of very cold weather early in 1979 resulted in further reductions in distillate stocks to a low of 113 million barrels at the end of March 1979.

To avert possible shortages for the 1979 and 1980 winter, DOE has encouraged refiners to modify their traditional light fraction runs to increase distillate fuel production and rebuild distillate fuel oil stocks to 240 million barrels of primary inventories in October of 1979. This inventory goal is designed to ensure an adequate supply of heating oil for the coming winter, and is assumed to be attained in all the projections. Thus, the projections of distillate fuel oil demand are based on the premise that supplies will be adequate to avoid curtailments during the forecast period.

V. SUPPLIES REQUIRED TO BALANCE BASE-CASE DEMANDS

Table 4 indicates the sources of domestic and foreign petroleum supply projected to meet demands in the base case. It is assumed that petroleum stocks will be rebuilt during the last two quarters of 1979 until total stock levels fall within the "normal stock range" as described and projected in successive editions of the DOE "Weekly Petroleum Status Reports." Such a level would include the 240 million barrels of distillate fuel oil inventories in October 1979 as discussed above. Consequently, current new supply from domestic production and imports must be large enough to meet projected demands and allow for appropriate additions to stocks.

Total domestic crude oil production is projected to exceed 8.5 million barrels daily during 1979 and fall only slightly below that level in 1980. The expected increases in Alaskan North Slope oil transported through the Alyeska pipeline appear almost large enough to offset continuing declines in other domestic production. The throughput capacity of the pipeline is scheduled to reach 1.37 million barrels daily at the end of 1979 and 1.42 million barrels daily at the end of 1980. Actual quarterly throughputs will average somewhat less than capacity, so the projections in Table 4 are adjusted accordingly. North Slope contributions to domestic supply are estimated to average 1.23 million barrels daily during 1979 and 1.37 million barrels daily in 1980.

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TABLE 4

a/
U.S. PETROLEUM SUPPLY/DEMAND BALANCE
Projections with Mid-Level Economic Growth: Normal Weather and Base-Case Prices
(millions of barrels daily)

	Historical						Projected					
	1978				1979		1979		1980			
Quarters:	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th
PRODUCTION												
Domestic Crude Oil	8.51	8.78	8.77	8.74	8.51	8.56	8.53	8.53	8.54	8.50	8.47	8.45
North Slope	0.85	1.12	1.17	1.21	1.20	1.22	1.23	1.28	1.35	1.35	1.37	1.40
Sub-Arctic	7.66	7.66	7.60	7.53	7.31	7.34	7.30	7.25	7.19	7.15	7.10	7.05
Natural Gas Liquids	1.57	1.58	1.55	1.57	1.75 b/	1.75	1.74	1.74	1.74	1.73	1.73	1.73
Other Domestic c/	0.42	0.59	0.58	0.79	0.28	0.66	0.50	0.50	0.50	0.50	0.50	0.50
TOTAL PRODUCTION	10.50	10.95	10.90	11.10	10.54	10.97	10.77	10.77	10.78	10.73	10.70	10.68
IMPORTS	8.08	7.50	8.21	8.47	8.56	7.84	8.74	8.38	8.58	8.11	8.35	8.46
Products	2.24	1.83	1.92	1.99	2.23	1.75	2.00	2.00	2.00	1.80	1.90	2.00
Crude Oil	5.84	5.67	6.29	6.48	6.33	6.09	6.74	6.38	6.58	6.31	6.45	6.46
EXPORTS	0.25	0.35	0.39	0.45	0.43	0.43	0.45	0.45	0.45	0.45	0.45	0.45
NET IMPORTS	7.83	7.15	7.82	8.02	8.13	7.41	8.29	7.93	8.13	7.66	7.90	8.01
TOTAL NEW SUPPLY (Net of Exports)	18.33	18.10	18.72	19.12	18.67	18.38	19.06	18.70	18.91	18.39	18.60	18.69
TOTAL DOMESTIC DEMAND	20.04	18.04	18.06	19.17	20.30	17.41	17.95	18.68	19.57	18.00	17.94	18.99
STOCK CHANGE d/ (All Oils)	-1.71	0.06	0.66	-0.05	-1.63	0.97	1.11	0.02	-0.66	0.39	0.66	-0.30
STOCK LEVELS d/ (millions of barrels)												
Open	1,304	1,149	1,155	1,216	1,211	1,064	1,152	1,254	1,256	1,197	1,232	1,293
Close	1,149	1,155	1,216	1,211	1,064	1,152	1,254	1,256	1,197	1,232	1,293	1,265

P = Provisional, based on data in the U.S. Department of Energy "Weekly Petroleum Status Report" and American Petroleum Institute "Monthly Statistical Report", June 1979

a/ 50 states only, excluding supplies for the Strategic Petroleum Reserve (SPR)
b/ New basis for reporting Natural Gas Liquids raised level of this series starting in January 1979.
c/ Includes processing gain, other hydrocarbon supply, and crude oil unaccounted for or lost.
d/ Excluding SPR

Sub-Arctic production (48 states plus South Alaska) is projected to decline at an average annual rate of 3.3 percent from 1978 to 1980 with the larger portion of that decline occurring in 1979. The decline rate in 1980 is tempered slightly by the phased decontrol of domestic crude oil prices along with the increases in world oil prices.

Domestic production of natural gas liquids (NGL) is projected to continue at the recently-reported higher levels recorded under a new mandatory reporting system. The previously-excluded or unreported supplies were allocated to the normal categories of product demand, largely for direct use as liquified petroleum gases. Offsetting increases are indicated in both the supply and demand tables starting in January 1979, and the discontinuities in these series from 1978 are generally noted. To the extent that the previously unrecorded NGL supply appears as additional refinery input, there could be some offsetting reductions in the indicated levels of processing gains at petroleum refineries. These are likely to be small, however, and processing gains and other additions to domestic supply are projected at 500 thousand barrels daily during the entire period.

As a result of the tendency of gains and declines to offset one another, total domestic production is projected to remain almost constant at about 10.7 million barrels daily during the forecast period. In light of the nearly constant or declining levels of total domestic petroleum demand, as discussed above, imports are also relatively unchanged, averaging 8.4 million barrels daily in both 1979 and 1980.

On a net-trade basis, total imports are projected at 7.9 million barrels daily averaged over the full years of 1979 and 1980, well below the high level of 8.5 million barrels daily average in 1977.

Imports of refined petroleum products are projected to be slightly below recent historical levels and follow the usual seasonal pattern, largely reflecting increased imports of fuel oils during the winter quarters.

Crude oil imports and total domestic production are projected to average about 15 million barrels daily through 1980, as shown in the summary in Table 5.

This level of crude oil supply could easily be accommodated in domestic petroleum refineries, and would indicate some decline in rates of capacity utilization during the forecast period. Operable crude oil throughput capacity was 17.1 million barrels daily on January 1, 1979. At that time, there was 872,000 barrels daily of additional crude oil distillation capacity under construction. Operable capacity in mid-1979 was reported a. 7.5 million barrels daily, and the refinery utilization rate in June was 86.2 percent—a rate somewhat higher than the implied rates required to process the crude oil supplies projected in Table 5. Increased quality requirements for refined products (specifically increased demand for unleaded gasoline) would increase the level of crude oil processing needed to produce a given volume. Refinery constraints for unleaded gasoline on downstream processing will be considered separately in a later analysis.

TABLE 5

CRUDE OIL SUPPLY FOR U.S. REFINERIES

(millions of barrels daily)

	Domestic Production	Imports	Total
1979			
First Quarter	8.51	6.33	14.84
Second Quarter	8.56	6.09	14.65
Third Quarter	8.53	6.74	15.27
Fourth Quarter	8.53	6.37	14.90
1980			
First Quarter	8.54	6.59	15.13
Second Quarter	8.50	6.31	14.81
Third Quarter	8.47	6.46	14.93
Fourth Quarter	8.45	6.46	14.91

In summary, the base-case projections during 1980 show little change from the 1979 levels. With the world supply situation apparently improved in recent months, it would appear that base-case requirements during 1980 could be met without resorting to supply allocations and other evidences of unfulfilled demand. At the same time, new disruptions may occur, which would limit supply, and extreme conditions in weather or changes in the economic outlook could alter the demand situation. In the following sections, the major factors likely to affect the demand levels are analyzed separately, to indicate what variations from the base case could occur under different conditions.

VI. EFFECTS OF CHANGES IN PETROLEUM PRICES ON DEMAND

The impact of alternative product prices upon petroleum product demand was evaluated by varying the price trajectories from the price assumptions in the base case demand forecasts. Table 6 presents the petroleum product demand forecasts given the three sets of price projections described earlier. Varying the price assumptions changes total demand projections by no more than 320,000 barrels daily relative to the base-case, or by less than 2 percent. This is consistent with previous analyses, which have indicated that the responses of demand to price changes for most petroleum products are relatively insignificant in the short-term.

The percentage change in demand relative to a percentage change in real prices, other relevant factors remaining the same, is called the price elasticity of demand for that product. It is a measure of the response of the total quantity demanded of the product to changes in the price. When the percentage change demand is less than the percentage change in price, demand for the product is said to be price inelastic. Most analysts have concluded that demand for petroleum products is generally price inelastic in the short term.

The estimates of elasticity appearing in this section are derived by varying the price assumptions from the base case, and examining the response of demand. In turn, the projected responses are based on statistical analysis of historical data on demand, prices, and other factors, and represent estimated elasticities based on recent

TABLE 6

PROJECTIONS OF U.S. QUARTERLY PETROLEUM DEMAND UNDER VARYING ASSUMPTIONS a/ OF THE LEVELS OF PETROLEUM PRODUCT PRICES
(millions of barrels daily)

Demand in 50 States	Historical 1979 1st	Historical 1979 2nd	Price Assumptions	Projected 1979 3rd	Projected 1979 4th	Projected 1980 1st	Projected 1980 2nd	Projected 1980 3rd	Projected 1980 4th
PRODUCTS									
			High	7.48	6.86	6.92	7.51	7.46	6.92
Motor Gasoline	7.12	7.09	Base	7.54	6.92	7.01	7.60	7.54	7.02
			Control	7.55	6.95	7.03	7.63	7.59	7.09
			High	2.61	3.60	4.03	2.87	2.61	3.63
Distillate Fuel Oil	4.31	2.91	Base	2.64	3.66	4.14	2.93	2.66	3.70
			Control	2.65	3.67	4.17	2.96	2.70	3.78
			High	2.59	2.86	3.19	2.38	2.56	2.93
Residual Fuel Oil	3.45	2.60	Base	2.67	2.99	3.31	2.49	2.66	3.07
			Control	2.67	3.0	3.33	2.51	2.69	3.12
			High	5.10	5.11	5.12	4.98	5.08	5.19
Other Products	5.42 b/	4.81	Base	5.10	5.11	5.11	4.98	5.08	5.20
			Control	5.11	5.14	5.13	5.00	5.10	5.21
			High	17.78	18.43	19.26	17.74	17.70	18.67
			Base	17.95	18.68	19.57	18.00	17.94	18.99
TOTAL	20.30 b/	17.41	Control	17.98	18.76	19.66	18.10	18.08	19.20

DEVIATION FROM THE BASE-CASE PROJECTIONS OF DEMAND
(Thousands of barrels daily)

Motor Gasoline	High	-60	-60	-90	-90	-80	-100
	Control	10	30	20	30	50	70
Distillate Fuel Oil	High	-30	-60	-110	-60	-50	-70
	Control	10	10	30	30	40	80
Residual Fuel Oil	High	-80	-130	-120	-110	-100	-140
	Control	0	10	20	20	30	50
Other Products	High	0	0	10	0	0	-10
	Control	10	30	20	20	20	10
TOTAL	High	-170	-250	-310	-260	-230	-320
	Control	30	80	90	100	140	210

a/ Assumptions for each case are Mid-Level Econonomic Growth & Normal Weather
b/ Change in reporting of Natural Gas Liquids (NGL) in 1979 results in basic discontinuity in demand series including products derived from NGL

market conditions and existing technologies. The price sensitivity analysis indicates that demand for motor gasoline shows little reaction to price changes associated with crude oil decontrol (holding world oil price trajectories constant). Demand declines less than 10,000 barrels daily (from a total of 7.5 million barrels daily) in the third quarter of 1979 in response to a 0.6 cent per gallon increase attributable to crude oil decontrol. By the fourth quarter of 1980, demand declines by about 70 thousand barrels daily (from a total of 7.0 million barrels daily) in response to a 4.6 cent per gallon increase, still a relatively small response. Larger impacts are generated by comparing base-case product prices (assuming crude oil decontrol and $20.00 per barrel OPEC prices) and the high product price scenario (crude decontrol and $23.50 per barrel OPEC prices). Gasoline demand in the third quarter of 1979 declines 60 thousand barrels daily (from a base case of 7.5 million barrels daily) in response to a 4.1 cent per gallon increase in gasoline prices, due to higher crude oil costs. By the fourth quarter of 1980, the decline is 100,000 barrels per day, generated by a 7.9 cent per gallon increase in gasoline prices. These changes in demand reflect a price elasticity of demand for motor gasoline of approximately -0.2, consistent with previous findings that motor gasoline is relatively price inelastic in the short run.

Distillate and residual fuel oil demand also display relatively small responses to changing prices in the petroleum demand models. By the fourth quarter of 1980, distillate demand declines by about

80,000 barrels daily (from 3.7 million barrels daily) in response to crude oil decontrol, which induces a price increase of 4.1 cents per gallon. Residual fuel oil demand, generally more price elastic in the short-term, declines 50,000 barrels daily (out of a total of 3.1 million barrels daily) in response to a price increase of $0.97 per barrel. The higher OPEC price increases generate more substantial declines in demand. Residual fuel oil demand declines by about 140,000 barrels daily in the fourth quarter of 1980 in response to price increases of $3.50 per barrel. Changes in fuel oil demands are consistent with a price elasticity of demand in the range of about -0.1 to -0.3 for distillate, and in the range of about -0.7 to -0.9 for residual fuel oil.

VII. WEATHER EFFECTS ON PETROLEUM PRODUCT DEMAND FORECAST

The effects of weather enter into any analysis of demand for petroleum products in a number of important ways. Most directly affected are products such as distillate fuel oil, when used for space heating in the residential, commercial, and industrial sectors of the economy. Colder than normal weather will directly increase demand for distillate to the extent that other fuels cannot be readily substituted. During the most recent three winters, average temperatures (while fluctuating markedly in the different regions of the country) have generally been below the 30-year (1941-1970) normal range in many areas.

Residual fuel oil can be used for space heating in large commercial and industrial establishments, and colder than normal weather will generate higher demand for the fuel.

Many establishments are prepared to substitute residual fuel oil for distillate and natural gas when fuel consumption requirements are abnormally high. This may be especially true during emergency relaxation of air pollution standards, when the substitution of cheaper but dirtier residual fuel oil is necessary to free distillate fuel for higher priority use such as residential space heating, or when increased residential and commercial demand for natural gas causes large curtailments of natural gas deliveries to industrial users. Abnormally cold weather may, therefore, induce a higher level of substitution than would normally be the case.

Residual fuel oil is a primary input in the generation of electric power. Abnormally warm or cold weather will increase the demand for electricity by final users, necessitating increased consumption of primary fuels by electric utility generating facilities. Although residual fuel oil is a relatively costly fuel for purposes of electric power generation, considerations of fuel availability, and the types of excess generating capacity available at any given time could dictate increased demand by electric utilities for residual fuel in an abnormal weather situation.

However, demand for motor gasoline is not as sensitive to abnormal weather conditions as is demand for other major petroleum products. Severe weather may curtail routine trips, or winter vacations may be postponed, cancelled, or interrupted. Conversely, warmer than normal fall and winter weather may induce additional driving and gasoline consumption for recreational purposes. In the commercial sector, delivery services may decline in periods of abnormally cold weather, further reducing the consumption of motor gasoline.

Table 7 displays the results of three demand forecasts designed to analyze the effects of varying weather conditions on petroleum product demand. Economic and price variables are given their base case values in this table. The three cases vary population-weighted heating degree days as follows: (1) the "normal" case assumes normal (1941-1970) weather patterns during 1979/1980; (2) the "cold" case assumes heating

TABLE 7

PROJECTIONS OF U.S. QUARTERLY PETROLEUM DEMAND UNDER VARYING ASSUMPTIONS a/ OF THE SEVERITY OF WINTER WEATHER
(millions of barrels daily)

Demand in 50 States	Historical 1979 1st	Historical 1979 2nd	Weather Assumptions	Projected 1979 3rd	Projected 1979 4th	Projected 1980 1st	Projected 1980 2nd	Projected 1980 3rd	Projected 1980 4th
PRODUCTS									
Motor Gasoline	7.12	7.09	V. Cold		6.92	7.01			7.02
			Cold		6.92	7.01			7.02
			Normal	7.54	6.92	7.01	7.60	7.54	7.02
Distillate Fuel Oil	4.31	2.91	V. Cold		3.77	4.[illegible]			3.81
			Cold		3.71	4.21			3.76
			Normal	2.64	3.66	4.14	2.93	2.66	3.70
Residual Fuel Oil	3.45	2.[illegible]	V. Cold		3.04	3.37			3.10
			Cold		3.01	3.34			3.08
			Normal	2.67	2.99	3.31	2.49	2.66	3.07
Other Products	5.42 b/	4.81	V. Cold		5.15	5.16			5.24
			Cold		5.13	5.13			5.22
			Normal	5.10	5.11	5.11	4.98	5.08	5.20
TOTAL	20.30 b/	17.41	V. Cold		18.88	19.81			19.17
			Cold		18.77	19.69			19.08
			Normal	17.95	18.68	19.57	18.0	17.94	18.99

DEVIATIONS FROM THE BASE-CASE PROJECTIONS OF DEMAND
(Thousands of barrels daily)

		1979 4th	1980 1st	1980 2nd	1980 3rd	1980 4th
Motor Gasoline	V. Cold	0.0	0.0			0.0
	Cold	0.0	0.0			0.0
Distillate Fuel Oil	V. Cold	110	130			110
	Cold	50	70			60
Residual Fuel Oil	V. Cold	50	60			30
	Cold	20	30			10
Other Products	V. Cold	40	50			40
	Cold	20	20			20
TOTAL	V. Cold	200	240			180
	Cold	90	120			90

a/ Assumptions for each case are mid-level econonomic growth & base-case prices
b/ Change in reporting of Natural Gas Liquids (NGL) in 1979 results in basic discontinuity in demand series including products derived from NGL

degree days 10 percent above normal during the winter (fourth and first quarter); and, (3) the "very cold" case assumes heating degree days to be 20 percent above normal during these periods.

It was decided to analyze only colder than normal scenarios because of the wide interest in the impact on distillate demand of severe winter weather.

As the table indicates, the impact on petroleum product demand as generated in the demand models, assuming even a 20 percent greater than normal level of heating degree days, is not very large. The largest impact, as expected, is on winter demand for distillate fuel oil.

In the fourth quarter of 1979, distillate demand is projected to increase by 50,000 barrels daily, or about 1.4 percent over the normal case, in response to 10 percent colder than normal heating degree days. Twenty percent colder than normal weather yields a total increase of 110,000 barrels daily over the base case, or about 3.0 percent. The first and fourth quarters of 1980 also yield weather impacts in the 60 to 130 thousand barrel per day range for distillate projections. The other major product showing some increase in consumption as a result of colder than normal temperatures is residual fuel oil even though it is not frequently used for space heating. Most of the increase in residual fuel is due to substitution for distillate and natural gas by commercial and industrial users, and to increased consumption by electric utilities in steam generating plants.

The most significant impact is seen in the projections for the first quarter of 1980, when 10 percent colder than normal weather generates an increase in demand of 30,000 barrels a day over the base case, or about 1 percent. The 20 percent colder than normal case yields an increased demand of about 60,000 barrels a day, or 2 percent of the total demand for residual fuel in the base case for that quarter. The smaller impact on demand projections for residual fuel oil compared to distillate as a result of varying weather assumptions is generally the result of the higher level of substitutability associated with residual fuel oil. Industrial uses of residual fuel oil can generally be substituted for by use of distillate fuel; electric power generation can be obtained through additional consumption of natural gas and coal.

Varying weather assumptions in this projection series are assumed to have no effect on forecasts of the demand for motor gasoline. This is because the demand for motor gasoline most likely responds more strongly to abnormally warmer weather, rather than the cold weather scenarios analyzed here.

VIII. POTENTIAL IMPACTS OF ALTERNATIVE ECONOMIC FORECASTS

While a recession in 1979 is the general consensus among the major economic forecasting services, there is considerable disagreement on the depth and length of the recession and the timing and speed of the recovery. The general downtrend will reduce petroleum product demand and, consequently, the demand for imports of crude oil and petroleum products. The magnitude and timing of the impacts on domestic product demand and imports is uncertain.

The time paths of GNP from the three DRI economic scenarios are presented in Table 1. On an annual basis the three economic scenarios presented are not highly divergent from one another with the result that petroleum demand impacts are not of a relatively large magnitude. Table 8 shows the effects on petroleum demand of the different economic assumptions. The greatest variation in petroleum demand occurs in the fourth quarter of 1980, when the difference between the high and low cases is 440,000 barrels daily or 2.3 percent of the base-case total petroleum product demand.

The difference in total demand between the high and base cases is small, reaching a maximum of 150,000 barrels daily in the fourth quarter of 1979. The difference in total product demand is only 20,000 barrels in both cases by the third and fourth quarter of 1980, reflecting the convergence of the underlying economic forecasts. The major differences in demand for individual products occur in distillate and residual fuel oil.

TABLE 8

PROJECTIONS OF U.S. QUARTERLY PETROLEUM DEMAND UNDER VARYING ASSUMPTIONS a/ OF THE LEVELS OF ECONOMIC GROWTH
(millions of barrels daily)

Demand in 50 States	Historical 1979 1st	Historical 1979 2nd	Economic Growth Assumptions	Projected 1979 3rd	Projected 1979 4th	Projected 1980 1st	Projected 1980 2nd	Projected 1980 3rd	Projected 1980 4th
PRODUCTS									
Motor Gasoline	7.12	7.09	High	7.52	6.97	7.04	7.59	7.53	7.03
			Base	7.54	6.92	7.01	7.60	7.54	7.02
			Low	7.50	6.91	6.94	7.44	7.36	6.87
Distillate Fuel Oil	4.31	2.91	High	2.64	3.66	4.15	2.93	2.65	3.69
			Base	2.64	3.66	4.14	2.93	2.66	3.70
			Low	2.62	3.63	4.10	2.87	2.59	3.62
Residual Fuel Oil	3.45	2.60	High	2.68	3.07	3.36	2.51	2.67	3.07
			Base	2.67	2.99	3.31	2.49	2.66	3.07
			Low	2.66	2.93	3.31	2.41	2.56	2.93
Other Products	5.42 b/	4.81	High	5.11	5.14	5.14	5.01	5.11	5.22
			Base	5.10	5.11	5.11	4.98	5.08	5.20
			Low	5.10	5.10	5.08	4.95	5.03	5.15
TOTAL	20.30 b/	17.41	High	17.95	18.83	19.68	18.04	17.96	19.01
			Base	17.95	18.68	19.57	18.00	17.94	18.99
			Low	17.88	18.57	19.43	17.67	17.54	18.57

DEVIATIONS FROM THE BASE-CASE PROJECTIONS OF DEMAND
(Thousands of barrels daily)

Motor Gasoline	High	-20	50	30	-10	-10	10
	Low	-40	-10	-70	-160	-180	-150
Distillate Fuel Oil	High	0	0	10	0	-10	-10
	Low	-20	-30	-40	-60	-70	-80
Residual Fuel Oil	High	10	80	50	20	10	0
	Low	-10	-60	0	-80	-100	-140
Other Production	High	10	30	30	30	30	20
	Low	0	-10	-30	-30	-50	-50
TOTAL	High	0	150	120	40	20	20
	Low	-70	-110	-140	-330	-400	-420

a/ Assumptions for each case are base-case prices & normal weather
b/ Change in reporting of Natural Gas Liquids (NGL) in 1979 results in basic discontinuity in demand series including products derived from NGL

In contrast to the high and base cases, the differences between the base and low forecasts are substantial. The resultant differences in the demand projections increase from 70,000 barrels daily in the third quarter of 1979 to 140,000 barrels daily in the first quarter of 1980, to 330,000 barrels daily in the second quarter, and to a maximum of 420,000 barrels daily in the fourth quarter. This maximum fourth quarter difference of 420,000 barrels per day is indicative of the largest GNP gap by the end of the forecast interval of $48 billion, in real 1972 dollars, between the low and base case economic forecasts.

IX. CONCLUSION

Insufficiency in U.S. petroleum supply, whether originating with decreasing production or upsurges in demand, has historically been met by increasing imports. As events in early 1979 indicate, it is no longer prudent to rely on imports to fill the supply gap, and it is no longer tenable to allow imports to grow without bounds. Consequently, future shortages may entail demand rationing, use of less desirable alternative fuels, and/or conservation in the use of energy.

The demand sensitivity cases prepared for this report and presented in Table 9 show the modifications in import requirements that result from different scenario specifications. High economic growth rates could lead to changes of only 50,000 barrels daily in import requirements for the full year 1980, while low economic growth would reduce import requirements by 320,000 barrels daily. Colder weather could add 180,000 to 240,000 barrels daily within a single winter quarter. The effect of crude oil price decontrol reduces import requirements by 140,000 barrels daily in 1980, while the high OPEC price trajectory will further reduce requirements by 280,000 barrels daily.

The last two rows of Table 9 represent first order scenario impacts of combining the individual sensitivity impacts into a "worst" case or "best" case. The worst case is the combination of levels of the key variables that would place the most severe strain on increasing import requirements. The figures in this row were obtained by aggregating

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TABLE 9

OIL IMPORT REQUIREMENTS SENSITIVITY ANALYSIS
(millions of barrels daily)

	79:III	79:IV	80:I	80:II	80:III	80:IV
Base Case						
Imports	8.74	8.38	8.58	8.11	8.35	8.46
Products	2.00	2.00	2.00	1.80	1.90	2.00
Crude oil	6.74	6.38	6.58	6.31	6.45	6.46
Exports	0.45	0.45	0.45	0.45	0.45	0.45
Net Imports	8.29	7.93	8.13	7.66	7.90	8.01
Price sensitivity						
Totals: High	-0.17	-0.25	-0.31	-0.26	-0.23	-0.32
Control	0.03	0.08	0.09	0.10	0.14	0.21
Weather Sensitivity						
Totals: V. cold	—	0.20	0.24	—	—	0.18
Cold	—	0.09	0.12	—	—	0.09
Economic Sensitivity						
Totals: High	0.00	0.15	0.12	0.04	0.02	0.02
Low	-0.07	-0.11	-0.14	-0.33	-0.40	-0.42
Worst Case (high economics, v. cold weather and base case prices)	0.0	0.35	0.36	0.04	0.02	0.20
Best Case (low economics, normal weather, and high prices)	-0.24	-0.36	-0.45	-0.59	-0.63	-0.74

the high economic, very cold weather and base-case prices impact data. The control prices were not used since President Carter's crude oil price decontrol order is established policy, unless Congress acts to re-impose controls. The highest pressure occurs in the winter quarters of both 1979 and 1980 because of the impact of very cold weather, when import requirements would be increased from 200,000 to 360,000 barrels daily.

The best case is the combination of levels of significant variables that would result in the greatest reduction in projected import requirements: low economics, normal weather and high OPEC prices. While this case would require approximately 600,000 barrels daily less in imports in 1980, except for normal weather, it would have the undesirable effect of a recession and higher imported crude oil prices.

The current pessimistic consensus on the economic outlook is reflected in the set of three economic forecasts used in the analysis. Slow growth and/or extended recessions place all three forecasts in a fairly narrow band during the period covered in this report. The potential weather effects on demand could conceivably be larger than used in this analysis. Historical changes, since 1976 in first quarter distillate demands, suggest that the abnormally cold first quarters in 1977, 1978, and 1979, contributed strongly to their increases of between 13 and 19 percent over first quarter demand in 1976.
While alternative supply scenarios are not presented in this report, domestic production and import requirements cannot be projected with

certainty. The projected level in Table 4 is presented as the most likely outcome, but unforeseen developments in world oil markets could alter supply prospects. When the demand variations are concentrated in a specific product, such as distillate fuel oil, the consequences of inadequate supply could be even more serious than these national totals imply.

On both the supply and demand sides, the base-case presented reflects probable results given the price, economic, and weather conditions specified. The variations in demand, shown in the demand sensitivity cases, indicate the need for measures or means to deal with uncertainties in the outlook for these key variables. Flexibility on the supply side may no longer be sufficient to deal with potential variations in demand, aside from the ability to draw on stocks or increase imports.

The earlier EIA June report comparable base case[3/] forecast net import requirements (imports minus exports) of 8.47, 8.86, and 8.68 million barrels daily for the third and fourth quarters of 1979 and the first quarter of 1980. The revised figures for this report are 8.29, 7.93, and 8.13 million barrels daily. Projections were not made for the remainder of 1980 in the June report. The differences of 180,000, 930,000, and 550,000 barrels daily resulting from the recently revised downward August forecast are caused by four factors: revised exports,

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3/ DOE/EIA-0184/5, Table 4 b, p. 16.

increased domestic production, lower economic growth, and higher OPEC prices.

Exports were revised upward by 50,000 barrels daily, thus reducing net imports, to account for recent historical changes in export levels. Production estimates were revised upward by 50,000 barrels daily in the third and fourth quarter of 1979, and 30,000 barrels daily in the first quarter of 1980. Accounting for the export and production revisions reduces the difference between both forecasts to 30,000, 830,000, and 450,000 barrels daily or 1, 10.5 and 5.5 percent (for each quarter) of the August net import projected. The remaining differences can largely be explained by revisions in economic and price forecasts affecting demand.

While the percentage differences in net imports, particularly for the fourth quarter of 1979, appears high, these percentages are not as meaningful as the corresponding values of .44, 4.4, and 2.3 percent of the total demand forecast. The economic forecast used in the June report was initially available in January 1979, in contrast to the July revision used in the current forecast. A recession is projected in the forecast used in the current report in the third and fourth quarters of 1979 and the first quarter of 1980. The difference in the January GNP forecast and the July forecast was $64.1 billion, in real 1972 dollars, or a 4.6 percent downward revision for the fourth quarter of 1979 (GNP in annual rates). The revised prices used

in the current projections incorporated the impacts of decontrol and the OPEC price increase that were not included in the June price forecasts. The June forecast utilized a nominal price of 75.1 cents per gallon for motor gasoline for the fourth quarter of 1979, while the corresponding price in the current forecast is 94.2 cents per gallon. The income and price effects are sufficient to reduce total demand by 4.4 percent for the fourth quarter of 1979 and 2.3 percent for the first quarter of 1980.

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